

## **AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application.

### **Listing of Claims:**

1. (currently amended) A culture chamber comprising:

(a) a tubular housing;

(b) a growth compartment within the housing;

(c) a liquid circulation system for circulating a culture medium through the growth compartment, the circulation system including a liquid inlet and a liquid outlet; and

(d) a plurality of membrane carrier assembly-assemblies transversing the growth compartment, wherein each membrane carrier assembly comprising comprises

a support cylinder having a first end in communication with the liquid inlet and a second end in communication with the liquid outlet, wherein the support cylinder transverses the growth compartment,

a molecular weight cut-off membrane secured to an exterior surface of the support cylinder, and

a chamber bordered on one side by the exterior surface of the cylinder and on an opposed side by an interior surface of the membrane, the chamber containing circulating culture medium, wherein the membrane allows the diffusion of a set of biochemicals having a defined molecular weight between the growth compartment and the chamber.

2. (cancelled)

3. (original) The culture chamber of claim 1, wherein the housing comprises  
  
a right circular cylindrical sleeve having a first and a second end; and  
  
a first and a second end fitting including  
  
an interior projection, the interior projection having an outer diameter that sealingly fits within a bore of the sleeve,  
  
a nozzle on an exterior side of the end fitting,  
  
a counterbore in the interior projection, and  
  
a through bore passing through the end fitting, the through bore extending from the nozzle to the counterbore.
4. (original) The culture chamber of claim 3, wherein the sleeve has at least one penetration port extending from the bore of the sleeve to an exterior surface of the sleeve.
5. (original) The culture chamber of claim 4, wherein the penetration port includes a gas venting means for allowing gas to escape from the growth compartment as the compartment is filled with fluid.
6. (original) The culture chamber of claim 4, wherein the penetration port includes a fill means for inserting fluids into or removing fluids out of the growth compartment.
7. (previously presented) The culture chamber of claim 1, wherein the liquid inlet is connected to the housing through an inlet liquid conducting swivel.
8. (previously presented) The culture chamber of claim 1, wherein the liquid outlet is connected to the housing through an outlet liquid conducting swivel.
9. (original) The culture chamber of claim 1, wherein the molecular weight cut-off membrane is dialysis tubing.

10. (original) The culture chamber of claim 1, wherein the molecular weight cut-off membrane is flexible.
11. (original) The culture chamber of claim 1, wherein the molecular weight cut-off membrane has a molecular weight cut-off of about 100,000 daltons or less.
12. (original) The culture chamber of claim 1, wherein the support cylinder is symmetrical about a transverse midplane.
13. (currently amended) ~~The culture chamber of claim 3~~ A culture chamber comprising:
  - (a) a tubular housing, wherein the housing comprises a right circular cylindrical sleeve having a first and a second end, and
    - a first and a second end fitting including
    - an interior projection, the interior projection having an outer diameter that sealingly fits within a bore of the sleeve,
    - a nozzle on an exterior side of the end fitting,
    - a counterbore in the interior projection, and
    - a through bore passing through the end fitting, the through bore extending from the nozzle to the counterbore;
  - (b) a growth compartment within the housing;
  - (c) a liquid circulation system for circulating a culture medium through the growth compartment, the circulation system including a liquid inlet and a liquid outlet; and
  - (d) a plurality of membrane carrier assembly assemblies transversing the growth compartment, wherein each membrane carrier assembly comprising comprises

a support cylinder having a first end in communication with the liquid inlet and a second end in communication with the liquid outlet, wherein the support cylinder transverses the growth compartment; and wherein the support cylinder has an axial blind hole in the first and second end of the cylinder, the blind hole aligned with the through bore of the end fitting when the cylinder is positioned in the counterbore of the end fitting and wherein an interior end of the blind hole intersects a plurality of radial cross holes extending to the exterior surface of the cylinder.

a molecular weight cut-off membrane secured to an exterior surface of the support cylinder, and

a chamber bordered on one side by the exterior surface of the cylinder and on an opposed side by an interior surface of the membrane, the chamber containing circulating culture medium, wherein the membrane allows the diffusion of a set of biochemicals having a defined molecular weight between the growth compartment and the chamber.

14. (previously presented) The culture chamber of claim 13, wherein the plurality of radial cross holes are coplanar and equispaced about the exterior surface of the cylinder.
15. (previously presented) The culture chamber of claim 13, wherein each radial cross hole intersects a surface pocket on the exterior surface of the cylinder.
16. (original) The culture chamber of claim 15, wherein the surface pocket has an arcuate cross-section.
17. (original) The culture chamber of claim 15, wherein the surface pocket extends from a point of intersection with the radial cross hole to a termination point on the exterior surface of the cylinder, the termination point positioned between the point of intersection and a mid-point of a length of the cylinder.

18. (previously presented) A culture vessel comprising:

(a) a housing having

a right circular cylindrical sleeve having a first and a second end; and

a first and a second end fitting including an interior projection, the interior projection having an outer diameter that sealingly fits within a bore of the sleeve to seal the first and second ends of the sleeve,

a nozzle on an exterior side of the first and second end fitting,

a counterbore in the interior projection, and

a through bore passing through the first and second end fitting, the through bore extending from the nozzle to the counterbore;

(b) a growth compartment within the bore of the sleeve;

(c) a support cylinder transversing the growth compartment, the support cylinder having a first and second end, each end having a liquid channel extending from the end of the cylinder to an exterior surface of the cylinder, wherein the liquid channel includes a blind hole in the end of the cylinder that intersects a plurality of coplanar radial cross holes extending to the exterior surface of the cylinder, and a plurality of surface pockets intersected by the radial cross holes, whereby the liquid channel is in liquid communication with the through bore of the end fitting whenever the cylinder is positioned in the counterbore of the interior projection; and

(d) a molecular weight cut-off membrane secured to an exterior surface of the support cylinder and overlaying the surface pockets in the exterior surface of the cylinder to provide a chamber between the exterior surface of the cylinder and an interior surface of the membrane, the chamber in liquid communication with the liquid channels of the support cylinder and the growth compartment, wherein the membrane allows the passage of a set of biochemicals having a defined molecular weight between the growth compartment and the chamber.

Claims 19-22 (canceled)

23. (previously presented) The culture chamber of claim 18 having a number of chambers transversing the growth compartment, wherein each chamber is a component of a liquid circulation system for circulating a liquid culture medium through the growth compartment.

24. (currently amended) A culture chamber comprising:

- (a) a tubular housing;
- (b) a growth compartment within the housing;
- (c) a liquid circulation system for circulating a culture medium through the growth compartment, the circulation system including a liquid inlet and a liquid outlet;
- (d) a plurality of membrane carrier assemblies transversing the growth compartment, each membrane carrier assembly comprising
  - (i) a support cylinder having a first end and a second end, each end having a fluid channel comprising
    - a blind hole in the end of the cylinder,
    - a plurality of coplanar radial cross holes extending from the blind hole to the exterior surface of the cylinder, and
    - a surface pocket on the exterior surface of the cylinder, wherein each surface pocket is intersected by one cross hole, and
  - (ii) a molecular weight cut-off membrane secured to an exterior surface of the support cylinder over the surface pockets of the fluid channels, wherein the membrane defines a set of biochemicals in the circulating culture medium for which passage through the membrane is restricted, and
  - ~~(iii)(e)~~ a chamber between the exterior surface of the cylinder and an interior surface of the membrane, the chamber in fluid communication with the liquid inlet and the liquid outlet.